| OFFICE OF MANNED SPACE FLIGHT<br>PROGRAM DIRECTIVE | M-D ML 3200.117<br>(Project) | DATE<br>DEC 9 1969 |
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APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 10A

TO : DISTRIBUTION

FROM:

DIRECTOR, APOLLO APPLICATIONS PROGRAM

SUBJECT: AAP Nonconformance Reporting and Corrective Action

REF : (a) Apollo Applications Reliability and Quality Assurance Program Plan, NHB 5300.5, May, 1967 Edition, Paragraph 2.6
(b) Apollo Applications Program Directive No. 11, Sequence and Flow of Hardware Developments and Key Inspection, Review and Certification Checkpoints
(c) NPD 5300.8, MSF Quality Assurance Audit and Discrepancy Reporting, October 13, 1967
(d) Apollo Applications Test Requirements, NHB 8080.3, October 13, 1967
(e) NMI 8020.3A, Manned Space Flight Flash Reports
(f) NMI 5310.1A, Reporting of NASA Parts and Materials Applications Problems
(g) NPC 250-1, Reliability Program Provisions for Space System Contractors, July, 1963 Editions, Paragraph 3.7
(h) Apollo Applications Program Directive No. 13, AAP Failure Mode and Effect Analysis; Single Failure Point Identification and Control

I. PURPOSE

The purpose of this directive is to establish requirements for reporting and resolving nonconformances encountered in manufacturing, testing, using and modifying AAP flight and ground support equipment in order to minimize nonconformance recurrence and to insure adequate closeout of all nonconformances prior to flight. Standards and requirements contained herein should be implemented, utilizing existing systems to the maximum extent possible, while recognizing the "one-of-a-kind" nature of certain AAP hardware. The term "nonconformance" includes, as used throughout this Directive, failures and defects, as defined in Appendix A.

The specific objectives of this directive are as follows:

A. To establish requirements for a closed loop nonconformance reporting and corrective action system.

B. To establish minimum requirements for reporting nonconformances and corrective actions to NASA Centers.

C. To establish a system for communication of information on nonconformances throughout AAP.

D. To make available summaries of nonconformances and corrective action status for key management reviews.

E. To provide for issuance of specific instructions, as needed, to implement requirements of this directive.

F. To set requirements for the conduct of failure analyses by qualified technical personnel when needed as shown by the information generated in the nonconformance reporting system.

II. SCOPE

This directive provides program standards for achieving uniformity of terms, practices and criteria to be used throughout the Apollo Applications Program in the generation of nonconformance data which can be readily combined, compared, and assessed for potential program impact. It is not intended that these standards be imposed on existing contractor systems where considerable confusion and expense would result. However, the change-over to these standard categories should be accomplished at the earliest feasible point in the contractor programs. In the interim, Centers are responsible for translating contractor criticality categories into these standard categories (where different) in reports to the Director, Apollo Applications Reliability and Quality Assurance.

III. BASIC REQUIREMENTS

A. Nonconformance recording shall commence with engineering release of design drawings to manufacturing. This recording shall continue through flight operations.

B. Closed loop systems will be implemented to assure effective monitoring, information feedback and timely resolution of all reported nonconformances.

C. The NASA activities with hardware responsibilities will issue instructions which clearly designate the organizations responsible for each action required for nonconformance closeout. The criteria to be used for flight readiness and recurrence control closeout of nonconformances are included in this directive as Appendix B.

D. Each Center Apollo Applications Program Office will make provisions for a system for storage and rapid retrieval of nonconformance information.

E. Reportable nonconformances as defined in IV.D will be assigned criticality classifications. Definitions of nonconformance criticality categories and guidelines for their assignment are included in Appendix C.

F. A failure analysis will be conducted on all criticality 1, 1S, 2A 2B and selected 3 nonconformances when the cause of the failure is not obvious without the use of laboratory or other special analysis techniques. Failure analysis may also be required for suspected hardware nonconformance or for marginal operation of the component regardless of criticality category.

G. Nonconformances will be resolved through authorized and documented corrective action to preclude recurrence in follow-on hardware. Where a configuration change is required, the engineering document number implementing the configuration change and the effectivity shall be included in the corrective action documentation.

H. Nonconformances will be investigated for recurrence. When a nonconformance does recur, analysis of the previous corrective actions will be accomplished as a part of nonconformance investigation.

IV. REPORTING TO NASA CENTERS

A. The contractor or NASA activity identifying a nonconformance will record each nonconformance and will report nonconformances to the NASA Center with design responsibility as delineated in B, C, and D, below. If the contractor has design responsibility, he will report nonconformances as delineated in B, C, and D below to the cognizant NASA Center. The NASA activity with design responsibility will assure closeout of each nonconformance reported. The activity with design responsibility will be responsible for forwarding corrective action information to the reporting activity.

B. For flight hardware, reporting will be initiated no later than start of post-manufacturing checkout of a stage or module.

C. For launch related GSE, reporting will be initiated at the launch facility no later than launch site assignment for each vehicle and continue through launch.

D. All hardware failures and those hardware defects which, if not corrected, would have the potential of significant impact on program schedule, hardware performance, or safety will be reported as specified in B and C, above.

E. Nonconformance reports will be written within 24 hours of isolation to the nonconformance. If the nonconformance is not isolated to the malfunctioning or defective component, it will be isolated to the lowest level system or subsystem that can be determined, within 24 hours of detection.

F. The operating organization is responsible for ensuring that a copy of the nonconformance report is received by the cognizant design organization as soon as possible, but not later than one week after isolation of the nonconformance.

G. Nonconformance reports and investigation and corrective action reports will be updated as required to reflect current status.

V. REPORTING - NASA CENTERS TO AAPO

A. Reporting Requirements

To meet the needs of the AAPO the Director, AAP Reliability, Quality, and Safety (Code MLR), requires two types of reports:

1. Nonconformances Summary Reports. To meet the requirements of Ref. (c), each Center AAPO shall prepare and submit a monthly summary of nonconformances by major flight assemblies (e.g., S-IB, S-IC, SII, SIVB, IU, CM, SM and launch related GSE).

2. Flight Readiness Status Reports. Each Center AAPO shall prepare and submit rapid response reports of all open criticality 1, 1S 2A, 2B and selected 3 nonconformances for hardware at KSC being prepared for launch. Closeout actions shall be reported in accordance with the Appendix B criteria as they occur.

B. Report Contents, Schedules and Responsibility

1. Specific directions as to report schedules and content will be provided by the Director, AAP Reliability, Quality and Safety (Code MLR).

2. Reporting will be the responsibility of the Center having design cognizance over flight hardware and for launch related Ground Support Equipment (GSE).

VI. REQUIREMENTS FOR EXCHANGE OF SIGNIFICANT NONCONFORMANCE INFORMATION

Dissemination of significant nonconformance information to management, and exchange of selected nonconformance experience between activities using similar hardware is a required element of an effective nonconformance reporting and corrective action system. To this end, two NASA Management Instructions (NMIs) have been issued to provide the mechanism for the dissemination and exchange of information:

A. Reference (e) is applicable when "Flash Reports" are submitted and shall be implemented by appropriate Center instructions.

B. Reference (f) will be followed when reporting nonconformance ocurrences regarding parts and materials. This NMI is applicable throughout the Apollo Applications Program and shall be implemented be appropriate Center instructions.

APPENDIX A

Nonconformance Definitions

The definitions listed below are to be used with this directive when exchanging and combining information from different sources in the Apollo Applications Program. It is not mandatory that these definitions replace existing ones already in use provided the existing definitions are compatible.

Corrective Action - Action taken to correct all conditions that contribute to, and are inherent in, a nonconformance (includes flight readiness action and recurrence control action).

Defect - A condition of any hardware in which one or more characteristics do not conform to the specified requirements. (This does not include failures).

Discrepancy - Failure or Defect.

Failure - The inability of a system, subsystem, component or part to perform its required function. (Criteria for "required function" includes specified limits, conditions and duration).

Failure Analysis - Laboratory analysis of the discrepant hardware to verify the failure and to determine the cause, mode and mechanism of failure.

Flight Readiness Action on Nonconformance - Action taken to ensure that a nonconformance has been resolved for mission assigned hardware.

Nonconformance - Failure or Defect.

Nonconformance Investigation - The study of a nonconformance in order to determine the circumstances that cause it and to arrive at a course of corrective action that will prevent its recurrence. (This may include failure analysis).

Open Nonconformance - Any nonconformance which has not been resolved by corrective action.

Recurrence Control Action - The action taken to prevent recurrence of the nonconformance on existing and follow-on hardware.

Remedial Action- The action taken to restore nonconforming hardware to operational status.

Unsatisfactory Condition - Failure or Defect.

II. RECURRENCE CONTROL CLOSEOUT

A. A nonconformance is closed for recurrence control action when assurance is provided that adequate action has been taken and is properly documented to preclude recurrence of the same problem on all existing and follow-on hardware. This action will normally consits of changes such as a design change, procedure change, further employee instruction, or tooling changes.

B. Engineering changes are not considered adequate for closeout until they have been approved by the appropriate configuration control board, including establishment of an effectivity date. Other changes (e.g., procedures or operating manuals) are not adequate for closeout until they are documented and issued. Also, when subsequent requalification is required, engineering changes are not considered adequate for closeout until satisfactory completion or qualification test.

NOTE: When applicable, a nonconformance report will be annotated "Not a Nonconformance" in lieu of "closed". For example, any nonconformance reported, that after investigation, is determined to be:

1. A suspected problem that is proven not to be an actual problem.

2. A problem traced to test equipment or operator error that has not affected the hardware being tested.

3. A problem involving prototype components.

APPENDIX B

Criteria for Flight Readiness and Recurrence Control Closeout of Nonconformances

1. FLIGHT READINESS CLOSEOUT

A. Within the nonconformance reporting and corrective action system, a nonconformance is closed for flight readiness when assurance is provided that action has been taken and properly documented to resolve the nonconformance for the hardware against which it was reported.

B. When the nonconformance is in criticality category 1, 1S, 2A or 2B flight readiness closeout is not complete until the next test prior to launch that will verify that the hardware operates properly, is identified, and:

1. Cause of failure is established and action required as a result of failure analysis is complete, or

2. Rationale needed to clear the space vehicle for launch is accepted.

C. When the flight readiness action is an approved engineering change with effectivity on hardware next scheduled for launch, flight readiness action is "closed by engineering change number (state)". Controls will be established to assure cross-correlation between the nonconformance and the engineering change to assure adequate, documented visibility that all engineering orders have been incorporated and verified, including retesting if appropriate.

D. Flight readiness closeout for the hardware next scheduled for launch shall include action taken as a result of nonconformances discovered on other space vehicles and support equipment using hardware of the same configuration.

APPENDIX C

Nonconformance Criticality Categories for Flight Hardware and Ground Support Equipment

Nonconformance encountered on the AAP shall be classified according to potential effect at the most critical period of countdown and/or flight of the manned mission and shall be coded as follows:

| Category | Potential Effect of Failure |
|---|---|
| 1 | Loss of life of crew member(s) (ground or flight). |
| 1S | Applies to Safety and Hazard Monitoring Systems. When required to function because of failure in the related primary operations system(s), potential effect of failure is loss of life of crew member(s). |
| 2A | Immediate mission flight termination or unscheduled termination at the next planned earth landing area. (For AAP includes loss of primary mission objectives). |
| 2B | Launch scrub. |
| 3 | Launch delay (For AAP includes loss of secondary mission objectives). |
| 4 | None of the above. |

NOTE: For KSC launch related GSE, Categories 1 and 1S may be considered to include loss of life, stage or spacecraft.

The following guidelines shall be used in nonconformance criticality category assignment:

1. Nonconformance criticality assignments are based on the criticality of the actual failure mode and not on the overall hardware criticality. Criticality for flight hardware and launch related GSE is based on the potential effect at the most critical period of countdown and/or flight of the manned mission. Criticality for other GSE, e.g., altitude test chambers and static firing stands, is based on the potential effect at the most critical period of operation for that GSE.

2. Criticality categories are also applicable when a Failure Mode and Effect Analysis (FMEA) does not identify the particular hardware or failure mode, but sound engineering judgement dictates that the problem could fit the above definitions (i.e., structural or electrical cabling problems involving critical components).

3. When a nonconformance is reported against hardware used in multiple applications, it shall be classified based on the most critical application.

4. Launch scrub (as distinguished from launch delay) is defined as a delay long enough to require retanking of propellants and/or reschedule of the launch to a later date.

5. When considerable analysis and expense are required to discriminate between criticality categories, the more critical category will be assigned.

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